Estimated Impact of GridWest on Variable Generation Costs and Congestion Re-dispatch Costs

Modeling Approach & Data

PacifiCorp made a number of runs using the ABB GridView model to provide a high level examination the effects of lowering short term wheeling and friction pancakes within GridWest. ABB GridView is a chronological, hourly production cost model incorporating a decoupled (DC) transmission powerflow. GridView uses linear programming optimization to minimize system production costs and for this study use powerflow and production cost data for the entire Western Interconnection. Both the base case with pricing pancakes and the scenario cases without pancakes are highly optimized in the model.

The data used for this effort was developed in the SSG-WI 2003 and RMATS 2004 regional planning efforts. These were open public planning processes that were cited by the Western Governors Association as part of their Energy Policy Roadmap. The data for plants, plant data (heatrates and VOM by plant vintage and type), fuel prices, regional gas price differences, loads, and transmission network/limits/limits were presented and discussed in a number of meetings. The meetings were both full group meetings and working committees. Comments were taken and implemented as appropriate. Once the data was collected, the model was run. Summary results and comparisons to actual operations were developed and presented at further public meetings. Additional comments were then sought to improve the data. The SSG-WI planning studies were performed once the data produced acceptable results. The SSG-WI 2003 Planning Report and data description are available at the SSG-WI web site http://www.ssg-wi.com/, while the RMATS report and supporting documents are located at http://psc.state.wy.us/htdocs/subregional/home.htm.

The public development, testing, verification and availability of this data is unique. PacifiCorp knows of no better currently available public source of data for Transmission Planning studies in the Western Interconnection. SSG-WI is in the process of producing a 2005 plan using improved data at the unit level instead of plant level. Although this data was not available in time for these studies, PacifiCorp felt that the current data could be used to estimate a lower bound on the benefits (the SSG-WI 2003 did not look at commitment and assumptions included several that would tend to minimize costs e.g. flat heat rates, units with same costs at same location added together). The SSG-WI 2005 data may be used at a later date.

PacifiCorp started with the most recent studies, the RMATS 2004. The transmission topology was modified by splitting the WECC Northwest area (most of Oregon, all of Washington, and parts of California and Idaho) into eight separate areas (BPA, PacW, PGE, PSE, Avista, SCL, TCL, and a Mid Columbia area).

Model Runs

The following ten studies were run.

Phase Shifters Move for free	Phase Shifters Move for $10/degree
Base with Perfect Scheduling (100% TTC)	Base with Perfect Scheduling (100% TTC)
Base with Imperfect Scheduling (90% TTC)	Base with Imperfect Scheduling (90% TTC)
GridWest w/ 100% TTC	GridWest w/ 100% TTC
GridWest w/ 95% TTC	GridWest w/ 95% TTC
GridWest w/ 90% TTC	GridWest w/ 90% TTC

The runs were for 2008 using average water and a base gas price of $4/mmbtu
.
Phase shifting transformer control was tested at two cost levels: 1). Free for a low level; and 2). $10/degree moved from zero for a high level. Time did not permit refinement of these estimates.

For the Base Case, pancakes were inserted between transmission systems based on the short term wheeling tariff plus $1.5/MWh to represent transactional friction. Transactional Friction can take many forms e.g. the cost of developing and analyzing information on possible trades, negotiating multiple transmission wheels, bid/ask spreads, etc. The $1.5/MWh was only intended to reflect the fact that there are trading costs besides transmission wheeling.

For the GridWest Case tariff charges were eliminated between GridWest transmission systems. The transactional friction was reduced 50% to reflect the GridWest will improve information and cut the costs of negotiating what would be today a multiple transmission wheel.

Three different levels of Total Transmission Capability (TTC) entered for transmission links to test the sensitivity of the benefits of eliminating pancakes to changes in scheduling limits. Under today's scheduling practices, WECC Control Areas schedule on contract paths between neighboring control areas creating a mismatch between flows and schedules. The Control Areas must stop scheduling firm when either the schedule limit or the flow limit in reached. Furthermore, firm transfers in one direction cannot be netted against firm transfers in another direction. This means that a path may be fully scheduled in both directions while showing zero net flow. Technically the path could be used to move interruptible power, but this would be a much lower value product (the party taking 100 MW of interruptible must bear the costs of keeping an additional 100 MW of spinning reserve). This mismatch between schedule and flows does not exist in a model such as ABB GridView. GridView only sees the flow of power from generator to load

and only hits a transmission limit when the flow is at the limits, a perfect match between schedules and flows.

As GridWest will implement a flow based scheduling method within its footprint, the mismatch between flow and schedule will be reduced. In addition, within the CCA there will be no control areas to schedule between. Thus the CCA will be able to net firm flows that start and end within the CCA (e.g. on the Northwest to Idaho path, IPC's Boardman and BPA's schedules east to load can net against PacifiCorp's Bridger schedule west to load), further reducing the mismatch between schedule and flow limits. This regains some usable transmission capacity. To determine the benefit sensitivity of reducing pancakes to schedule limit changes, path limits were modeled at the 100% TTC (assuming no unusable capacity today) and 90% TTC in the Base runs and at 100% TTC, 95% TTC, and 90% TTC in the GridWest runs.

Two levels of cost for using Phase Shifters (a transmission control device) were tested. The first had Phase Shifters moving for no cost. The second had Phase Shifters costing $10/degree. Both sets of runs are listed below.

Modeling Results

GridView estimates the minimum variable fuel and non-fuel generation costs and the cost of transmission charges, both use charges and the costs of re-dispatching for transmission limits. All GridView runs are highly optimized. Assumptions include perfect information, perfect foresight and efficient contracting for loads, generation availability, generation costs, transmission availability, transmission flows and phase shifter controls. The actual imperfect information, foresight and contracting practices would increase the real costs, particularly for the base case (as Grid West would improve several of these items) cannot be measured by GridView. Nor would sub-hourly cost issues (AGC, operating reserves, balancing, etc) be addressed in GridView.

Variable generation Costs

The changes in annual variable fuel and O&M costs with and without GridWest are summarized below. More detail is provided in the appendix.

GridWest Variable Generation Cost Savings			
for 2008 using RMATS Data Average Water			
Dollars in Millions			
	Phase Shifters Free	Phase Shifters $10/degree	Average
Savings Base less GridWest Case			
Base 100% TTC less GW 100% TTC	$ 26	$ 19	$ 22
Base 90% TTC less GW 90% TTC	$ 24	$ 12	$ 18
Base 90% TTC less GW 95% TTC	$ 54	$ 52	$ 53
Base 90% TTC less GW 100% TTC	$ 78	$ 80	$ 79

Impact on Congestion Cost Estimates
GridView keeps track of the re-dispatch costs (congestion costs) and wheeling charges on transmission interfaces. The annual sum of these charges, less the wheeling and friction charges, gives a measure of the annual congestion costs. Changes in the annual congestion costs with and without GridWest are summarized below. More detail is provided in the appendix.

GridWest Reduction in Congestion Costs for 2008 using RMATS Data Average Water Dollars in Millions			
	Phase Shifters Free	Phase Shifters $10/degree	Average
Savings Base less GridWest Case			
Base 100% TTC less GW 100% TTC	$ 118	$ (13)	$ 52
Base 90% TTC less GW 90% TTC	$ 90	$ (102)	$ (6)
Base 90% TTC less GW 95% TTC	$ 199	$ 88	$ 143
Base 90% TTC less GW 100% TTC	$ 258	$ 187	$ 223

Benefit Estimates

De-Pancaking
The model results show savings in fuel and variable O&M costs ranging from $12 to $26 Million per year. Say an average of about $20 Million for the studied year if effective transmission limits are constant.

Sensitivity to Increased Transmission Capability
However, if the flow based scheduling and control area consolidation effectively recovers 5% of path TTC the fuel and variable O&M savings are estimated at about $50 Million for the year, a gain of $30 million due to the 5% improvement. If there is an effective 10% increase in TTC, the cost savings was estimated at about $80 Million, a gain of $60 Million

Change in Congestion Costs
Concern has been expressed that the lack of pancakes under GridWest might increase the costs of managing congestion on the system. The GridView model runs did not support this view. For the cases where effective transmission limits are constant the change in congestion costs ranged from increased congestion of $113 Million to decrease congestion of $118 Million. The simple average for the cases with no effective increase in transmission limits was a cost decrease of over $20 Million. For the sensitivities where GridWest was assumed to improve effective transmission limits, congestion costs decreased over $140 million for the 5% improved case and decreased over $220 Million for the 10% improved case.

Conclusion

There are several benefits that are anticipated to result from adopting Grid West. The benefits fall into several types requiring different types of models to approximate. The GridView model, with RMATS 2004, data can give insight on three items: 1). the value of de-pancaking; 2). The Value of increasing the effectively usable transmission; and 3). the potential for increased congestion re-dispatch costs. De-pancaking saves about $20 million for the modeled 2008 year in fuel and non-fuel generation costs. Increasing the effective transmission limit 5% saves an additional $30 Million while increasing the effective limit 10% saves $60 Million. These savings were captured while, if anything, decreasing the overall cost of congestion.